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Quantitative Conditions and Convergent Operations That Are Compatible With the Universe as a Persistent Generator of Successive Simulations

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ABSTRACT

The capacity for computer-like simulations to be generated by massive information processing from electron-spin potentials supports Bostrom's hypothesis that matter and human cognition might reflect simulations. Quantitative analyses of the basic assumptions indicate the universe may display properties of a simulation where photons behave as pixels and gravitons control the structural organization. The Lorentz solution for the square of the light and entanglement velocities converges with the duration of a single electron orbit that ultimately defines properties of matter. The approximately one trillion potential states within the same space with respect to the final epoch of the universe indicate that a different simulation, each with intrinsic properties, has been and will be generated as a type of tractrix defined by ±2 to 3 days (total duration 5 to 6 days). It may define the causal limits within a simulation. Because of the intrinsic role of photons as the pixel unit, phenomena within which flux densities are enhanced, such as human cognition (particularly dreaming) and the cerebral regions associated with those functions, create the conditions for entanglement or excess correlations between contiguous simulations. The consistent quantitative convergence of operations indicates potential validity for this approach. The emergent solutions offer alternative explanations for the limits of predictions for multivariate phenomena that could be coupled to more distal simulations.

Indexing terms/Keywords

Simulations; Photons as Pixels; Gravitons; Rest Mass of Photons; Rate of Expansion; Electron Orbital Time; Entanglement; Human Cognition; Universe

Academic Discipline And Sub-Disciplines

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INTRODUCTION

One of the primary assumptions of physics is that ultimately all phenomena within the various levels of scientific discourse will be explained or accommodated by application of fundamental principles from which appropriate quantifications converge with some precision and predictability. Contained within the set of all phenomena is human brain activity with which cognitive processes such as thinking are strongly correlated and from which technical developments and inferences about the universe are generated. If this contention is valid then the structural conditions that produce human-generated phenomena should reflect the fundamental and universal principles. For example, an increasingly apparent technical capacity derived from computer technology produced by the consequences of human brain activity is the phenomenon of "simulation".

In 2003 Bostrom [1] examined the potential that human beings are or could be living within a computer simulation and discussed the ramifications. Since that time development of quantum computers involving spintronics [2] and associated electron spin conditions that constitute digital units have revealed an extraordinary potential for both information processing and storage. The estimates by Hunter et al [3] that the entire earth (~10^{49} unpaired electron spins; 10^{42} polarized electrons) could be employed as a polarized electron source for long-range spin-spin interactions suggests this structure upon which terrestrial living systems depend might be employed to generate information.

This is remarkably similar to Bostrom's estimate [1] that the computational power of the planetary mass computer could be 10^{42} operations per second. He concluded that an optimal nanotechnological design would be sufficient for a post-human civilization to generate a large number of ancestor-simulations. The logical extrapolation is whether or not the entire universe might display the properties of a simulation. Here we present quantitative evidence and convergent operations to support this hypothesis. The basic relationship would require the photon as a basic pixel, the role of the graviton and entanglement, and the interpretation that the potential for the approximately 10^{12} "universes" within the same space over the age of the universe would allow continuous creations of simulations every 5 to 6 days. The resulting properties could explain some of the intrinsic properties of the temporal limitations of cause-effect.

THE PIXEL IS THE PHOTON

Any simulation metaphor if applied to the universe as a material condition requires a measureable minimum quantity or pixel. The most parsimonious candidate is the rest mass photon [4]. It should emerge as the solution when the energy of the entire universe is observed (measured) within time-frames that reflect its oscillation of zero point vacuum energies [5], a variant of Planck's Time, for the entire age. Quantitative solutions support this presumption.

Assuming the typical estimate of the total mass of the universe is ~$2.4{\cdot}10^{52}$ kg, the total energy would be $2.2{\cdot}10^{69}$ J [6]. However within the context of pixel durations whose unit value is equivalent to Planck's Time (PT) there would be $0.18{\cdot}10^{44}$ PT per s and when applied across the total final (epoch) age (~98 billion years) of the universe of $3{\cdot}10^{18}$ s [7] the pixel related energy would be $1.08{\cdot}10^{131}$ J. For this application the total age was obtained from the inverse of the product of Gσ where G is the Newtonian Gravitational Constant and σ is a unit proton ($1.67{\cdot}10^{-27}$ kg) per cubic meter. This is comparable to solutions by other methods [8].

Assuming the latter duration the ultimate width of the universe expanding at the velocity of light would be ~$9{\cdot}10^{26}$ m. If the universe is relatively flat, for example similar to galaxies, its depth would be about $1/30^{th}$ of the width. Ignoring the relatively small contribution from curvature of this elliptical volume the rectangular volume would be $24.3{\cdot}10^{78}$ m^3. If Planck's length was assumed to be a voxel or pixel then its cubic volume is $4.25{\cdot}10^{-105}$ m^3. This means there would be $5.71{\cdot}10^{183}$ Planck's voxels or pixels in the entire universe. The potential for a "foxel", a four dimensional unit involving a unit space-time aggregate, would not necessarily be excluded.

The total pixel duration energy involving the increments required for the numbers of Planck's Time units for the complete duration of the universe ($1.08{\cdot}10^{131}$ J) divided by the total number ($5.71{\cdot}10^{183}$) of Planck's pixels within the total volume of the universe would be $0.2{\cdot}10^{-52}$ J per pixel. This value is almost exactly the quantity predicted for the upper limit of the rest mass of a photon as c^2 approaches 1. This could occur when the whole duration and final volume of the universe is considered as a single unit or "singularity". Consequently from the perspective of the smallest known spatial unit and time where vacuum energies operate and virtual particles and real particles interact and transform [9], the operating unit would be the photon.

GRAVITON, LIGHT, ENTANGLEMENT AND DETERMINING THE STRUCTURE OF PHOTON AGGREGATES

Although the rest mass photon energy per Planck's voxel allows the condition for a hologram [10] in which simulations could occur as successive variations in representation within space-time, operations must exist to organize the photon configurations upon which matter will ultimately be manifested and shaped at the macrocosmic level. The relationship would be similar to the determinism of the properties of specific elements of the Periodic Table by the configurations of protons and electrons. In the present context we assume analogous subunits which determine when, where and in what organization protons, electrons and neutrons will occur. The numbers of constructive units could involve other dynamic components as recently suggested by Netchitallo [11].

One candidate that might be optimally related to photons is the graviton. Its mass (upper boundary) has been estimated to be ~$2{\cdot}10^{-65}$ kg [12]. The graviton or some homogenous unit that behaves as a condensate by which the universe is integrated may involve velocities much faster than c which defines properties of locality and require values that mediate non-locality. A similar concept has been developed by Rowland [13] and implicitly permeates the assumptions of most cosmological and relativistic theories.

We have shown with three different methods that one of the consistent values for diffusivity when total magnetic and electrical energies of the universe are arranged as quotients [14] or the four major descriptors of the total set: G, mass, length, and duration are appropriately related is about $2.4{\cdot}10^{23}$ $m{\cdot}s^{-1}$ [15]. The time required for this process of diffusivity to permeate the functional distance of the universe would be in the order of 8 to 9 min. If the duration for the action of entanglement is instantaneous as some theorists assume, then the ~8 min could reflect instead the latency for the manifestation of the process. In either scenario there would be a potentially predictable and discrete value to measure.

Because of its multiple involvements with the integration of large-scale space we have referred to this diffusivity as ψ (lower case psi) or the entanglement velocity or latency. The coefficient may not be exact, but assuming a close proximity to our current estimates the square of that value multiplied by the upper limit of the rest mass of a graviton (which has been estimated to be ~10^{-65} kg) would be ~10^{-19} J. This quantum interval is within the median range of the near ultraviolet, visible, and near infrared wavelengths of light. This band is where the interesting wave and particle properties of photons are most conspicuous. The production of light energies by the product of the upper rest mass of a graviton and the square of the entanglement velocity may suggest that it might modulate the aggregation of photons into the informational units upon which matter originates.

TIMING OF THE SIMULATION

The relationship between the two fundamental velocities, c which is associated with temporal processes and serial locality, and ψ, which is associated with excess correlations, "simultaneity" and non-locality should reveal a value that defines basic matter. The relationship would be expected to be within the temporal domain that defines the properties of matter. One solution that relates velocities is the essential Lorentz contraction which is traditionally depicted with the reference velocity compared to the velocity of light. It can be expressed in an alternative form as:

$$\sqrt{[1-(c^2 \cdot \psi^{-2})]} \qquad (1).$$

In this instance the temporal displacement would be $\sim 2.5 \cdot 10^{-16}$. If the reference were 1 s, this would be equivalent to $\sim 2.5 \cdot 10^{-16}$ s.

This value is remarkably similar to the time required for an electron to complete one orbit around a proton as defined by the Bohr magneton. Such single completions are the bases of (dia) magnetism, the energy associated with Planck's constant, and the magnetic moment of an electron. All of these aggregates define the nature of matter and its relationship with energy. For example as shown previously [16] the angular magnetic moment of an electron immersed in a typical strength galactic magnetic field which is also immersed within an intergalactic magnetic field ($\sim 10^{-12}$ T) of comparable strength results in an energy value. The duration equivalent of that value, by dividing it into Planck's constant, is the estimated value for the final epoch (age) of the universe. This condition would be expected for a simulation or a simulation process that must be protracted.

The numbers of graviton equivalents within the total mass of the universe would be 10^{52} kg divided by 10^{-65} kg or 10^{117} units. This value when divided into the final volume of the universe ($2.4 \cdot 10^{79}$ m^3) results in $\sim 10^{-38}$ m^3 per graviton. The equivalent linear distance is $\sim 3.2 \cdot 10^{-13}$ m. The product of the rest mass of an electron ($9.11 \cdot 10^{-31}$ kg), the equivalent linear distance squared (10^{-25} m^2) and the square of the orbital frequency of an electron ($6.8 \cdot 10^{15}$ s^{-1})^2 or $4.6 \cdot 10^{31}$ s^{-2} is $4.2 \cdot 10^{-24}$ J. When divided by Planck's constant the resulting value approaches the 1.42 GHz that defines the most ubiquitous frequency in the universe: the hydrogen line. Such integration of the space-equivalent from the volume occupied by gravitons with the mass of an electron and the time required to complete an orbit from which magnetic moments and other properties of matter and electromagnetism emerge would be conducive for the transformation of the "structural blueprint" mediated by gravitons into matter.

In addition if the closest estimate of $\sim 3 \cdot 10^{-13}$ m is multiplied by the constant of 8π which reflects the second derivative of the surface of a sphere in cosmological contexts [17], the equivalent linear distance is $\sim 2.5 \cdot 10^{-12}$ m. This is within the range of the Compton wavelength of an electron which indirectly relates Planck's energies and mass for this particle. From the perspective of mechanism, this too would be optimal. If the averaged length of space occupied by an averaged graviton density equivalent is within the range of the electron's wavelength then direct access to the conditions that affect the states of matter as well as its organization might occur simultaneously. This would be required for a simulation program that would organize the photon pixel units into specific configurations of matter. However it also assumes a state at some point where the gravitons are homogeneously distributed but their influences upon photons (that determine the local structure of matter) are more localized. Otherwise aggregates of matter, such as organisms, planets and stars, would not likely occur.

Assuming the upper limits of the rest mass of a photon to be 10^{-52} kg and the graviton to be 10^{-65} kg, the number of graviton mass equivalents within a single photon would be $\sim 10^{13}$. This ratio is the same order of magnitude as the ratio of space-to-matter within the boundaries of the Bohr atom. From its rounded radius of 52 pm it displays a volume of $5.89 \cdot 10^{-31}$ m^3. The volume of the rest electron and proton is $\sim 9.3 \cdot 10^{-44}$ m^3. This assumes a radius of $2.8 \cdot 10^{-15}$ m and $0.88 \cdot 10^{-15}$ m for the electron and proton, respectively. The quotient of these two values indicates that approximately $0.6 \cdot 10^{13}$ increments of space (Δs) or states containing different proton-electron pairs could exist within the same space occupied by a Bohr atom. This ratio is not limited to the atomic scale. The amount of mass occupied by the volume within the solar system, even with conservative estimates of outer boundaries, displays a similar ratio of about one part of matter per trillion parts of space. Such similarities of proportions or ratios across levels of discourse, from microcosm to macrocosm, would be consistent with the consequences of a simulation process that operates within the boundaries of space-time.

Other approaches have considered this approximately 1 part per trillion of matter-to-space to allow the condition for simultaneous or parallel states or universes [18]. However within the context of the universe as a simulation or a continuous generator of simulations there is a different interpretation. We suggest that the process associated with the graviton whose mass multiplied by the square of the entanglement velocity ψ would be $\sim 10^{-19}$ J or visible and paravisible light might be the single point determinant in each of the potentially 10^{12} to 10^{13} different states or universes that could exist within the same space bounded by the simplest atom.

RATE OF EXPANSION OF SIMULATIONS

Within the "multiple states" universe the presumption is that all 10^{12} to 10^{13} Δs exist simultaneously [18]. If the universe is operating as a quantum computer, then *each state or Δs would be a simulation*. If it began to generate simulations from the origin and continues to generate simulations then the rate of this production, assuming it is linear, could be estimated. The final epoch for the universe based upon Gσ where G is Newton's Gravitational Constant and σ is the average mass density of 1 proton per cubic meter indicates a total duration of $\sim 3 \cdot 10^{18}$ s. When divided by the calculated $0.63 \cdot 10^{13}$ potential states or universes that could exist within the space occupied by a conventional atom the quotient of the two values could reflect the occurrence of a new simulation (the manifestation within a new Δs) every $\sim 4.8 \cdot 10^{5}$ s. Stated alternatively a new and additional simulation has been and will be manifested every ~5.5 days over the temporal extent of the universe.

If this is valid, then one of the most enigmatic features of causality within local space-time might be accommodated. We imagine this productive generation every ~5.5 days to be a continuous process rather than increments of 5 to 6 days. Within this interval causality and deterministic properties would be maximal. However it would be expected to be statistically distributed around a central tendency such that the duration would be ±2.8 days. The most

parsimonious shape and correlative mathematical geometry would reflect the attenuation of energies bilaterally such as the tractrix. In other words the processes associated with a simulation that would be determined by causal factors and locality within that simulation would be interrelated maximally within this narrow temporal boundary. This would suggest that the greatest predictability for statistical events within that simulation would be maximal within this boundary.

As more simulations were generated, each with potentially different parameters that defined their generation, the capacity to predict would decline logarithmically with respect to properties that reflect locality and cause-effect. However non-locality and excess correlations could still occur between more and more temporally separated simulations because of the involvement of photons. As a result all subsequent simulations from the original simulation would still share properties that would satisfy the conditions for entanglement. This could accommodate calculations and models that indicate entanglement can occur between photons that were never associated [19] with no limitation for distance [20]. The interpretation is also consistent with hypothesis of Hu and Wu [21] as well as the essential definition of Schrodinger's entanglement as described by Aczel [22].

Whereas the locality within space for a single graviton, according to our quantifications, would be within the range of the wavelength of the electron in order to control the configuration of matter, the locality within space for the photon would be larger. On average, assuming the upper boundary for the rest mass of a photon is ~10^{-52} kg and the mass of the universe is ~10^{52} kg there would be 10^{104} photon equivalents within the universe. Assuming a volume of 10^{78} m^3 a single photon equivalent would occupy a volume whose symmetrical linear distance would be between 1 nm and 10 nm. This is the domain of the ion channels and width of the plasma membrane of mammalian living cells.

Consequently even though the simulations of the next universe or state that could occupy the potentially one trillion degrees of freedom within the boundary of an "atom" would occur every approximately 5 to 6 days and become less and less likely to be affected by the others' causality and locality at the level of electron dynamics, excess correlations might still occur between all of the photons that share the unit graviton.

THE ROLE OF ENTANGLEMENT

Several different experiments have demonstrated excess correlation between either photochemical or proton (pH) reactions occurring within two separate spaces separated by non-traditional distances if both shared specific types of magnetic fields [23-25]. During these conditions the physical reactions within the two loci behave as if they have been superposed to the same space. The magnetic fields that produced this effect were very specific and involved a changing angular velocity of a phase shifting magnetic field around a circular array of solenoids. The concept was a direct application and prediction of Tu et al [4] who demonstrated that the emergence of a rest mass for a photon occurs when the group velocity is uncoupled from the phase velocity.

The most consistent and conspicuous phenomena that emerged from these powerful demonstrations of excess correlation were first, its transience, and secondly the duration of that transience. Even with the optimal combination of field presentations the excess correlations attenuated after about 8 min. Interesting the time required to traverse the functional universe at the velocity of ψ which is $2.4 \cdot 10^{23}$ $m \cdot s^{-1}$ would be about 8 min. This upper boundary was evident for the photon emission studies as well as the reciprocal shifting in pH within coupled volumes of spring water. We have reasoned that this limitation is essential in order to maintain the integrity of cause-effect within local mechanisms. If the excess correlations were not temporally limited the processes of locality that determine cause effect might be irreversibly untangled. Not only would cause and effect be affected but the conditions that maintain the balance between predictable matter-energy relationships and random fluctuations might be disrupted.

However entanglement should still exist within and across all of the simulations generated every 5 to 6 days within the potential space occupied by matter until it is saturated. Assuming the entanglement velocity of $2.4 \cdot 10^{23}$ $m \cdot s^{-1}$ the distance traversed during the $4.8 \cdot 10^{5}$ s associated with the generation of a single simulation would be $1.1 \cdot 10^{29}$ m. This is a factor 10^3 greater than contemporary estimates of the diameter of the universe. As suggested previously linear distances may not reflect topologically represented distances or space that is coiled within different levels. For example we [26] have shown quantitatively that the conspicuous discrepancy between the average magnitude for magnetic flux density in the universe and what it should be based upon the estimates of total energy (~$2 \cdot 10^{69}$ J) varies within error measurement from the constant 21.3 π^4 . It emerged when the products of the closed geometries (for a circle) in each spatial dimensions (perimeter, area, volume) and time ($2\pi rf$) were obtained. The balance of this metric ($m^7 \cdot s^{-1}$) with G, and the appropriate exponents for the universe's mass, distance and duration was the origin of the actual value for ψ.

When the linear distance traversed during the duration of a single simulation is divided by 21.3 π^4 the resulting distance is $5.3 \cdot 10^{25}$ m. In comparison the radius of the current estimate of the duration of the universe (13.3 billions of years) results in a radius of $1.2 \cdot 10^{26}$ m. On the other hand the Schwartzchild solution for the radius of a singularity ($2MG \cdot c^{-2}$) is about $3.3 \cdot 10^{25}$ m or a diameter of $6.6 \cdot 10^{25}$ m. From this perspective what is apparent superficially as the extraordinary distance involved with the processes that contribute to the entanglement between successive simulations of the universe is more optimally accommodated by the geometric processes of the universe's spatial structure below the structure of matter (<10^{-16} m). At this level the universe as a phenomenon displays more of the characteristics of being a total singularity.

One would expect that the conditions to facilitate intercalation between successive simulations should be consistently exhibited. Several approaches [27] have indicated that the quantum of energy that could relate the averaged universal force within each Planck's pixel distributed over the hydrogen line wavelength is ~10^{-20} J. As noted previously

the energy produced by the upper rest mass of a photon ($2\cdot10^{-52}$ kg) when multiplied by the product of the entanglement velocity ($2.4\cdot10^{23}$ m·s^{-1}) and the velocity of light in a vacuum ($3\cdot10^{8}$ m·s^{-1}) is $1.4\cdot10^{-20}$ J.

The earth is not in the same "space" every year because the entire solar system orbits the center of the galaxy once every approximately 250 million years. The orbital velocity is estimated to be ~$2.42\cdot10^{5}$ m·s^{-1}. Applying the classic ½ mv^2 (where m=mass and v=velocity) relation this would mean that the mass of an electron ($9.11\cdot10^{-31}$ kg) multiplied by the square of the orbital velocity of the solar system would be equivalent to the energy of between 2 to $3\cdot10^{-20}$ J. This is within range of the energy associated with the second shell of the hydrogen atom associated with movement of protons through water [27], the discrete energy associated with an action potential from neurons [28], and the potential energy between the hydrogen bonds of a water molecule [29].

POTENTIAL CONTRIBUTION FROM PHYSICAL COGNITIVE ("THOUGHT") PROCESSES AND THEIR SIMULATIONS

In his sagacious text, Bohr [30] suggested that the physical processes labeled as or attributed to human "thinking" or cognition involved energies that were within the magnitude of quantum processes. Indeed the action potentials of the axon, the fundamental 0,1 process upon which the complexities of information within the brain are generated, involve such quantums. The energy associated with the effects of a change of 120 mV (the peak-to-peak shift) of an average action potential upon a unit charge ($1.6\cdot10^{-19}$ A·s) is ~$2\cdot10^{-20}$ J [28]. This quantity is the conservation of energy associated with the separation between charges along the surface of the plasma cell membrane from which the resting potential is generated [28]. The value is also the same unit that emerges at the level of Planck's Length when parameters of the entire universe are considered. Recently Garner and Vedral [31] calculated that minimal distance of displacement for an event to be tracked throughout the history of the universe was about 10 μm (the average diameter of a neuron). The frequency equivalence of this wavelength when the velocity of light is employed as the reference results in an energy of ~10^{-20} J.

If the electromagnetic patterns associated with human thinking were to be reproduced as simulations then a series of quantifications should converge with known parameters that describe the entire universe as a set. There are several examples. First, the average energy density of the universe has been estimated to be 10^{69} J divided by 10^{78} m^3 or 10^{-9} J per cubic meter [32]. Within the volume of the human cerebrum (10^{-3} m^3) the equivalent energy would be 10^{-12} J. Because each action potential is 10^{-20} J, a population of ~10^{7} neurons each discharging an action potential within 1 ms (the absolute refractory period) would be required to approach the universal density. This number of neurons is considered to be a quantity associated with the experience of a percept [33] or the reactivation of a representative experience ("a memory").

Secondly, the time required for ψ to traverse the averaged linear extent of the human cerebrum (~11 cm) would be $0.46\cdot10^{-24}$ s. When this value is divided into Planck's constant ($6.626\cdot10^{-34}$ J·s) the resultant energy is $1.45\cdot10^{-9}$ J. Even if the volume (rather than the linear distance) of the cerebrum is considered the brief durations of the action potentials (10^{-3} s) would allow the condition for the universal energy density to occur at least transiently within cerebral space. It may not be spurious that the averaged linear distances in three dimensions of the cerebrum of the human species is effectively 1/2λ of 21.1 cm, the hydrogen wavelength. This means that there would be some quantitative proportion of the entire species whose brain parameters would be within that narrow band.

Third a representation of the access to the entire universal set which extents across the known distances and the 10^{-20} J units of cognition should be convergent. The source of the 10^{-20} J associated with the neuronal action potentials is the movement of sodium ions while the resting membrane potential is associated primarily with the slightly heavier potassium or chloride ion. According to the gravitational energy relationship when solved for distance:

$$l=(J\cdot r^2)\cdot(G\cdot m^2)^{-1} \qquad (2),$$

where J is 10^{-20} J, r is the distance between ions (~10 to ~11 nm), G is the gravitational constant, and m is the mass of any two ions. Here the Na ion within a mass of 29 Daltons ($1.66\cdot10^{-27}$ kg per Dalton) is selected as the operative dynamic. The solution for l, the distance that the gravitational force must be applied to obtain 10^{-20} J, is ~$2.5\cdot10^{25}$ m. This is within the boundary of the estimated width of the universe as a Schwartzchild singularity. In other words for the gravitational force between the two masses to be equivalent to the 10^{-20} J associated with a single action potential or the universal energy at the level of Planck's Length, the force must be distributed over the length of the universe (the entire set).

IDENTIFICATION OF SPECIFIC STRUCTURAL PARAMETERS AND STATES FOR INTERCALATING SIMULATIONS

The energy associated with the numbers of neurons (~10^{7}) involved with a single percept, assuming each neuron discharged on average at 10 Hz and each action potential ($1.1\cdot10^{-1}$ V·$1.6\cdot10^{-19}$ A·s) is $2\cdot10^{-20}$ J would be $2\cdot10^{-12}$ J. Given the average brain volume is $1.3\cdot10^{-3}$ m^3 the energy bulk density would be 10^{-9} J per cubic meter. This is the same order of magnitude as the total energy of the universe (10^{69} J) divided by its likely current volume (10^{78} m^3) which is 10^{-9} J·m^{-3}. From this perspective the activities within spatial boundaries of the human brain have the capacity to behave as homogenous quantities that define the universe as an averaged whole.

For the visual cortices of the brain technical measurements by Carandini and Ferster [34] showed that the estimated values for the threshold of spike discharges of neurons was -54.4±1.4 mV with a linear gain of 7.2±0.6 spikes·s^{-1} per mV. Consequently the energy involved with each spike would be 10^{-3} V·$1.6\cdot10^{-19}$ A·s or $1.6\cdot10^{-22}$ J and when

multiplied by 7.2 spikes per would be $1.15 \cdot 10^{-21}$ W. The surface area of a neuron with an average diameter of 10 μm is $3.14 \cdot 10^{-10}$ m^2. This means the flux power density for this linear gain would be ~$3.5 \cdot 10^{-12}$ $W \cdot m^{-2}$. This is within the range of flux density associated with the emission of photons from the right side of the brains of people while they engage in imagination of white light [35]. The order of magnitude is also the median value for the ultraweak photon emissions from all living systems [36-37].

An intrinsic solution associated with 10^{-12} $W \cdot m^{-2}$ per cell becomes important when its coupling to the basic unit of energy 10^{-20} J is revealed [38]. The equivalence between the two requires energy per s to be multiplied by an inverse diffusivity. If resistivity is assumed to be wave impedance (376.73 Ω) applied over the hydrogen wavelength ($2.116 \cdot 10^{-1}$ m) the value is $7.792 \cdot 10^{1}$ Ω·m. When divided by the magnetic permeability of a vacuum ($1.26 \cdot 10^{-6}$ $N \cdot A^{-2}$), the diffusivity is $6.326 \cdot 10^{7}$ $m^2 \cdot s^{-1}$. The inverse value is $0.16 \cdot 10^{-7}$ $s \cdot m^{-2}$. The simplest frequency to relate photon density to energy would be the orbital time of an electron. The fundamental frequency for this time, the Bohr value, is $6.59 \cdot 10^{15}$ s^{-1}. The rationale for this approach was developed in more detail elsewhere [38].

The product of $1.5 \cdot 10^{-20}$ J, the inverse diffusion of $0.16 \cdot 10^{-7}$ $s \cdot m^{-2}$, and the Bohr frequency is $1.6 \cdot 10^{-12}$ $W \cdot m^{-2}$ which is within error of the flux density of photons potentially released from the cerebrum during rates of change of neuronal activity regions involved with visualization. The relationship would be consistent with the capacity for human cognition to contribute to or be affected by the progressive simulations that move through reference-time as the shape of a tractrix which is a bilateral decelerating pattern within a boundary within the range of ± 2 to 3 days. The involvement of the universal wave impedance, hydrogen wavelength and single orbital time of a Bohr atom could allow the type of relationship that has the potential to be applied over the universe. The equivalence with 10^{-20} J, which is the resulting energy when the total force within the universe is divided by the numbers of Planck's voxels and multiplied by the 21 cm wavelength, indicates that the 10^{-12} $W \cdot m^{-2}$ generated by cerebral cortical activity and cognition if coupled to the transform of inverse diffusivity and the orbital time of an electron could diffuse through all of space. This would be a necessary condition for a spatial and temporal proliferation of a simulation.

The type of information that might contribute to the simulation and the state in which this contribution is most likely to occur can be revealed by discerning which phenomena are most associated with the 7 to 8 Hz pattern that is associated with the 10^{-12} $W \cdot m^{-2}$ flux photon density. According to Buzaki [39] theta oscillations (4-8 Hz) represent the on-line state of the hippocampus as well as the "circuit" of structures (the Papez pathway) the mediate emotional experience. The disproportional participation of this pathway would suggest that emotional information would constitute a major theme or determinant within subsequent simulations. The cortices of the parahippocampal gyrus, primarily because of the presence of grid cells, facilitate the encoding of space [40]. The direct coupling between the 40 Hz gamma cycle of the cerebral cortices with the 7 Hz cycle of the hippocampus corresponds to the neuronal aggregate for one item in a set of items maintained within working memory [41].

As summarized by Heinemann et al [42], the entorhinal cortices and the hippocampus are a functional unit within which theta rhythmic activity occurs during the chemical and physical changes associated within the representation of experience, i.e., "the storage of memory". Alsonso and Klink [43] showed that the input from the entire cerebral cortices converges onto the superficial layers (II and III) of the entorhinal cortices. Thus this one region would be a focus for the energy of the entire cerebrum (10^{-9} $J \cdot m^{-3}$) which matches the average universal energy density. These superficial layers are the primary source of input to the dentate gyrus and hippocampus. Consequently the "daily" information within the entire cortical manifold ultimately converges within the hippocampal region for consolidation and "long-term" memory storage.

The cells within the entorhinal cortices maintain a constant subthreshold oscillation between 5.5 Hz and 14.5 Hz which overlaps with the theta and alpha band in classical electroencephalographic definitions. The mean voltage level for these oscillations is 2.6±0.5 mV at an average frequency of 8 Hz. The energy would be ($2.6 \cdot 10^{-3}$ V)·($1.6 \cdot 10^{-19}$ A·s)·(8 s^{-1}) or $3.3 \cdot 10^{-22}$ W. The averaged soma diameter was about 22 μm [43] or $4.79 \cdot 10^{-10}$ m^2. This indicates the power density associated with this persistent subthreshold oscillation, independent of the perturbations associated information processing, would be ~10^{-12} $W \cdot m^{-2}$. The continuous generation of this subthreshold oscillation and resulting potential flux density would be consistent with a cerebral location where photons or other units that mediate information could contribute to successive simulations as they are generated.

There is evidence of unique persistence properties of the parahippocampal (entorhinal cortices) region particularly within the right hemisphere. Rouleau et al [44] measured significant attenuation within the theta and beta-gamma bands over the right caudal hemisphere only of resting subjects if the cerebrum was covered by a thin copper mesh. Other regions of the brain did not display this effect. Direct measurements of frequency-dependent voltages of dead human cerebrums that had been fixed for decades revealed consistently higher power of ~0.2 $\mu V^2 \cdot Hz^{-1}$ within the right hemisphere. The effect was particularly evident in the grey (cortical) matter of the right parahippocampal region. The phenomenon may be more pervasive than suspected. Rouleau et al [45] measured parity-coupling of the 4-8 Hz band (theta activity) within the right parahippocampal volumes during the quantitative display of excess correlation between pairs of human subjects whose brains shared circularly rotating magnetic fields (with changing angular velocities) known to produce "entanglement" in photon reactions [23]. Each member of the pair was separated by ~6,000 km.

Subsequent experiments by Rouleau and Persinger [46] involving key structures within both hemispheres of dead human brains that had been fixed for more than 20 years demonstrated that different increments of stimulation between 1 Hz and 30 Hz with either sine-waves, square-waves, or pulsed currents indicated a marked anisotropic responding. Only the right hippocampus displayed frequency-independent increased in gamma (40 Hz) power compared to the left hippocampus. The parahippocampal structure responded only to 7 Hz pulsed patterns by amplifying a wide

band (8-30 Hz) of power. These results indicated that human brain as an organ, even when it is clinically dead but fixed properly, displays the properties that could be congruent with interacting with a simulation. It is well known that the clusters of neurons within the parahppocampal gyrus are loci where the different sensory code systems are transformed to a relatively homogenous frequency-based pattern which allows the translation and integration of multimodal signals.

The historical arguments of "insufficient antenna length" with respect to the physical interfacing between microstructure within the human brain, specifically through the fractal-like dendritic patterns that dominate the outer shell (the cerebral cortices) of the human brain, and adjacent large space may not longer be valid. Modern communication devices (cell phones) employ intrinsic antennae whose sensitivity is more related to complex geometry than to length. For example the Sierpinksi antenna is functionally a regressive number of triangles with characteristics of both a fractal and a gnomon. It might be considered the analogue of the minimum number of vectors (3) to produce a resultant zero, a condition that would be consistent with phase or frequency modulation of information rather than shifts in intensity. The radiation patterns generated and absorbed from this configuration "tripole" occur within spatial frameworks that overlap with neuronal structures.

Ellamil et al [47] recently published detailed information concerning the actual loci within human brains that are activated at the time a person reports a "spontaneous thought". fMRI data indicate activation of the parahippocampus gyrus (entorhinal cortices) in both hemispheres as well as the major structures involved with the Default Network Mode [48-49]. The later involves highly correlated structures throughout the brain that are involved with the subjective experiences of personal thought. This network mode is activated when a person sits quietly in the dark with minimum external stimulus input. It could be considered the "intrinsic pattern" of the human energies of self-awareness and rudimentary consciousness. From the perspective of the simulation condition, the persistence of this mode and the involvement of the region (parahippocampus and hippocampus) whose flux densities could access the physical coupling to the continually generated simulations every 5 to 6 days would allow the conditions for human cognition to contribute to or be represented within these simulations.

If magnitude of flux density enhances the contributions of cerebral content to the successive stimulations, then one particular state would be particularly weighted. This is the dream state that occurs for 5 to 15 min approximately every 90 min to 120 min during sleep. During dream periods there are concomitant increases in heart rate irregularity, synthesis of protein within the brain ("memory consolidation"), relative hypotonia (decreased muscle tone) of the entire body below the neck, and a marked enhancement of right hemispheric activity. Energy utilizations within the hippocampus and parahippocampal regions are increased disproportionately while the prefrontal regions, associated with cognitive structure and reasoning, are actively inhibited [50]. The surface electroencephalographic activity is very similar to the waking state while the hippocampal regions display more theta activity.

The content that contributes to the imagery associated with dream episodes is strongly influenced by what the person has experienced within the previous 1 to 3 days. Two of the most consistent features of anticipated or "precognitive" experiences are that they occur primarily within dream states and most of the verified reports occur within 3 days of the experience. Persinger [51] graphed these data which conspicuously revealed the ±3 day distribution in the shape of a tractrix. These numerical constraints are not limited to human reports. They relate solar activity and physical chemical processes such as the ubiquitous storm-glass activity reported by Barnovsky et al [52]. In 1995 Klocheck et al [53] reviewed and pursued a "cosmophysical" radiation of a non-electromagnetic process that affected physical and biological systems. The operational descriptions were similar to the "gravitoelectromagnetism" 5D universe model published recently by Netchitailo [11]. The relationship between photons and gravitons was also elegantly developed 20 years ago by Amoroso [53] who suggested that gravitons are confined photons of the unified nonlocal field that curves space-time. According to Klochek et al [54] a gravitational-like wave would accommodate the anomaly of sharp changes in sedimentation rates of blood proteins 6 to 8 min before astronomical sun rise as well as the photon-driven metachromasia of bacteria that preceded active formations on the sun by 4 to 6 days.

CONCLUSIONS

The constituents of matter and its structure may be dependent upon the arrangements of photon equivalents and their configural organization by gravitons. The energy per Planck's pixel from the total photonic energy for the duration of universe is equivalent to the rest mass of a photon that could converge with the rest mass of a graviton. When it is multiplied by the square of the entanglement velocity the resulting energy is light. The Lorentz contraction for the ratio of the squares of the velocity of light in a vacuum and entanglement results in displacement that is the orbital time of an electron from which the properties of matter emerge. Quantifications indicate that over the duration of the universe the generation of simulations will occur on average once every 5 to 6 days until the potential space within which matter (about one part per trillion) exists is saturated. The necessary emergence of entanglement from photon involvement indicates that strongly correlated physical processes (such as human cognition) could be affected as well as influence temporally adjacent simulations. Although the unique volume of the human brain during cognition corresponds with the average universal energy density, the temporal properties of neurons within the regions of the brain associated with memory consolidation and dreaming would be disproportionately contributory.

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Michael A. Persinger, Ph.D. is a Full Professor at Laurentian University in Sudbury, Ontario, Canada. He is affiliated with a number of different programs including Biomolecular Sciences, Behavioural Neuroscience and Human Studies as well as the Quantum Molecular Biology Laboratory where he is examining the relationship between 10^{-20} J events within the brain and complex functions. Dr. Persinger and his colleagues have experimentally demonstrated the validity of Cosic's Molecular Resonance Recognition Model, Bokkon's Cerebral Photon Field Hypothesis and the efficacy of proton driving patterned magnetic fields that inhibit the growth of cancer cells but not normal cells. He is an interdisciplinary scientist whose primary goal is to integrate the physical sciences, social sciences and humanities according to their fundamental operations. Within the last 50 years he has published more than 500 technical articles in a variety of areas that range from Astronomy to Zoology. His present experiments are focused upon understanding the relationship between the structure of space and distribution of energy, the shared dimensional equivalence of quantized gravitational and electromagnetic fields, and the empirical demonstration of an intrinsic entanglement velocity.

Stanley A. Koren is the creator of the Digital-to-Analogue (DAC) optocoulpler technology for complex magnetic field circuits and the Complex software that operates the systems. He has published extensively in the areas of physical cosmology, electronic systems analyses, and application technologies. He is trained as an Electronics Engineering Technologist and holds a degree in Mathematics and Computer Science. Professor Koren and Dr. Persinger, while at Laurentian University, have collaborated on multiple projects over the last 30 years that included the creation and disruptions of excess correlations in physical and biological systems. They developed a neurophysics model that relates the nature of the proton and electron to cosmological variables such as the Hubble parameter and their connection to the physical substrates of living matter. His favorite focus is discerning the relationship between time, Casimir phenomena, and the intrinsic nature of the neutral hydrogen line. Professor Koren has been systematically pursuing the application of quantum theory beyond the single particle. He holds a number of patents with Dr. Persinger and is a licensed radio amateur: Canadian call sign VE3PSE.